

REPORT OF THE COMMITTEE

OF THE

NATIONAL BOARD OF TRADE

ON A

CONTINUOUS WATER LINE

OF TRANSPORTATION

THROUGH VIRGINIA.

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RICHMOND:

GARY, CLEMMITT & JONES, PRINTERS.

1869.

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14 J. P. O. S. Circa 1812

# REPORT.

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To the National Board of Trade  
of the United States of America.

During the annual session of your honorable body, which was held in December last at Cincinnati, you had under consideration the following resolutions, presented by the Louisville Board of Trade:

1. "Resolved, That cheap transportation for its heavy products to the markets of the world, is not only a necessity to the West, but equally demanded by the best interests of the whole country.

2. "Resolved, That the most feasible plan to secure this end, is to provide a direct and continuous line of water communication between the Mississippi river and the Atlantic ocean, in a latitude favorable to the safe carriage of grain in bulk, and yet comparatively free from obstructions by frost; that such a communication can be readily secured, by the Ohio, Kanawha and James rivers, through Virginia and West Virginia, to the Atlantic ocean near the mouth of the Chesapeake bay.

3. "Resolved, That said line of water communication is a work of great national importance, and as such is entitled to receive such aid from the general government as will secure its completion at the earliest possible period.

4 "Resolved, That the Executive Council are hereby appointed a committee to memorialize the Senate and House of Representatives of the United States, on behalf of this body, and ask them to take the subject of said water line communication into favorable consideration at an early day, and to grant such aid as may be necessary to secure its early completion."

Whilst these resolutions were pending, at quite a late period of your session, when but a short time was left for the transaction of business, the following resolutions were submitted on behalf of the Louisville Board of Trade, and were adopted:

"The subject of the resolutions submitted by the Board of Trade of Louisville, and now under consideration, is one of great importance, and has been but recently brought to the attention of the majority of this body, and should be fully examined and maturely considered before final action: Therefore,

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*Resolved*, That the whole subject be referred to a committee of fifteen, with instructions to fully examine the same, and report to the Board at its next meeting.

*Resolved*, That the report of this committee be placed in the hands of the Secretary forty days previous to the next annual meeting, that he may transmit copies of the same to the constituent bodies."

In pursuance of this resolution the following committee was appointed on this subject:

Mr. Porter, of Louisville,	Mr. Munn, of Chicago,
Mr. Stanard, of St. Louis,	Mr. Taylor, of St. Paul,
Mr. Burwell, of New Orleans,	Mr. Gano, of Cincinnati,
Mr. Topp, of Memphis,	Mr. Wetherill, of Philadelphia.
Mr. Brown, of Portland,	Mr. Parr, of Baltimore,
Mr. Converse, of Boston,	Mr. Hughes, of Norfolk,
Mr. Hincken, of New York.	Mr. Carrington, of Richmond.
Mr. Monroe of Dubuque,	

Before leaving Cincinnati your committee held a meeting, and after taking measures for drafting a report on the subject submitted for their consideration, adjourned to meet at the White Sulphur Springs on the 15th of August following. Pursuant to such adjournment your committee met at the time and place aforesaid, and having duly examined the subject of your resolutions, beg leave to submit the following

## REPORT.

### THE FIRST RESOLUTION.

1. Nothing could be more true than the declaration of the first of the series of resolutions which your honorable body has submitted for our consideration—"that cheap transportation for its heavy products to the markets of the world is not only a necessity to the West, but equally demanded by the best interests of the whole country."

#### *Transportation to Market the great need of the West.*

The problem now most seriously engrossing the attention of commercial men at the North, at the East, and throughout the West, is that of cheaper intercommunication between the great interior region of our continent and the seaboard. The necessity for its solution is becoming more and more urgent every day. The railroads are overburdened with freight, and are inadequate to its transportation, at rates which draw it forth from remote parts of the interior.

The question of cheaper transportation is only another form of the question of adequate means of transportation—for the mo-

ment that freight prices are so reduced as to permit produce to go to market, from where it is grown in the fertile West at a profit to the producer, immediately such a volume of it is mobilized as to overtax the capacity of the avenues of transportation. The problem of cheap carriage is therefore no other than that of adequate means of transportation.

The productions of the interior are magnifying every year. They grow in aggregate more rapidly than the means of transmitting them to market can be multiplied. Western production is constantly pressing unduly upon the means of transportation. The multiplication of railroads in the interior is more rapid than that of railroads connecting the interior with the seaboard. The effect of the extended railroad and navigation systems of the West is to stimulate production more rapidly than existing lines of transportation can be augmented in capacity. Insufficiency in the means of outlet produces high freight charges, and the remark of all eminent writers on political economy is true, that impassable mountain chains interpose no greater barriers to trade than high prices of freights.

*Extent of this Inland Transportation System of the West.*

The stimulating causes now in operation to augment the production of the West are very powerful in their influence:

1. The natural increase of population, augmented by the immense immigration from foreign countries and from the Atlantic States, is peopling the interior regions of the continent with a rapidity unexampled in the history of the human race; and the production of the country is increasing in the same unprecedented ratio.

2. The railroad system of the Mississippi and Lake Valleys has grown to an aggregate of 17,622 miles in length. This system is acting as a powerful stimulant to the production of that prolific region in every part of it.

3. The inland navigation of the West is of immense expansion. Official reports give the aggregate length of steamboat navigation on the Mississippi and its tributaries at 16,674 miles. The flat boat and batteaux navigation of the headwaters and branches of these great streams increases this navigation by more than ten thousand miles; and in the course of a short time slack water and canal improvements will swell the grand total of western inland navigation to at least fifty thousand miles. It will ultimately be considerably more if the European principle should obtain in this country, that every stream 19 feet wide and 18 inches deep may be rendered navigable.

River navigation has assumed new importance of late by the inauguration of a cheaper and more efficient system of water transportation. On the western rivers they have instituted the system of steam tugs and barges on a large scale. The effect is virtually

to convert the river channels into railroads, the steam tugs being locomotives, and the barges being freight cars. Incorporated companies of large capital own the tugs and barges, and run them upon time schedules, just as railroad companies run their trains—the trains picking up barges as they pass different wharves and leaving others. The expense is but a fraction of railroad transportation, and the river channels are prized as nature's substitute for long railroad tracks. As there are nearly 17,000 miles of steam-boat navigation on the western rivers, the effect is virtually to add 17,000 miles of railroad track to the transportation business of the West.

Thus the total length of our main lines of transportation in the West, on which steam is the motor, has reached 34,000 miles.

The area of country embracing this vast system of railways and of navigation is nearly two millions of square miles; and when population reaches an average of fifty persons to the square mile, will contain one hundred millions of people whose leading industry will be agriculture.

The stimulus imparted to production by the railway and navigation systems which have been mentioned, seconded by the unexampled growth of population there going on, is producing an immense development of export products. In 1860 there were eighteen millions of tons of produce to spare from the West, not one-half of which went off. It failed to go off either from the non-existence of sufficient means of transportation, or by reason of the prohibitory cost of freightage over great distances. What the amount of produce now is which could be spared for outside markets from the interior, cannot be stated with authentic accuracy, and the statistics of the forthcoming census must be awaited. But it would be an under statement to say that it has reached twenty-five millions of tons. On the other hand it would be an exaggeration to estimate that twelve and a half millions of these tons now go out to market over all the existing avenues of transit.

The existing deficiency in the facilities of transportation increases as the centre of production recedes westward. A few years ago this centre was in Ohio. It has steadily retrograded through the states of Indiana and Illinois. It has now crossed the Mississippi, and is still moving westward. The centre of demand at the West for the necessary supplies from the East, including machinery, other manufactures and merchandise, salt, iron and coal, is receding with equal step into the far interior, to a still greater distance from the source of supply; so that, while the demand for intercommunication is constantly increasing, the continually widening distance between the places of production and of consumption is adding to the expense of communication.

Already very many of the products of the West, wanted at the East, will not bear transportation. Even in the state of Illinois, corn, the staff of life—needed at the East to fill hungry mouths—has been burned for fuel, on the score of economy; and in Dubuque,

on the western bank of the Mississippi, within the last five years, corn in the cob has been burned for domestic purposes as cheaper than other fuel, the ruling price of wood being \$10 per cord, and of anthracite coal \$20 per ton.

The area of country in the West which can be served by the Erie canal is continually decreasing; for, as the country bordering on the lakes becomes settled up, the breadth of land under cultivation increases, and the produce from this increased cultivation, being nearer to the lakes, cuts off that from the far *West* by monopolizing the canal.

To show the inadequacy of the present means of outlet for transmitting such a volume of produce as would be spared for market, we may estimate the maximum theoretic capacity of the Erie canal for through produce at seven millions of tons; we may estimate the utmost capacity of all the railroads now leading across the Alleghanies at eight millions of tons, for *through freights*. It would be safe, to estimate the amount of western produce which now goes out by the channels of the St. Lawrence and the lower Mississippi, at four millions of tons. (The capacity of the lower outlets of the Mississippi and of the St. Lawrence for discharging produce, is, of course, not measured by the quantity actually going out, but rather by the capacity of existing appliances for its shipment.) Thus, the utmost theoretic capacity of these several avenues of outlet does not exceed 19,000,000 of tons. The quantity of western through tonnage *actually* moving over them is but little more than half this amount. Yet the present tonnage which could be spared by the West and which could be forwarded to market, if its products were mobilized by cheap carriage, and by ample avenues of transportation, would be twenty-five millions of tons. (See article I, *Hunts' Magazine* for August, 1868.) It is not therefore merely a question, whether we shall add new railroads to those already engaged in the work, or whether we shall merely open new canals, or whether we shall merely increase the appliances necessary for transmitting produce through the lower Mississippi and the Gulf. Resort must be had to all these expedients, and still there will be a grevious deficiency in the means of conducting the vast transportation.

*Western Production seeks market in the direction of the Atlantic.*

Whether this huge volume of produce is to find outlet to the markets of the world in the direction of the Atlantic or of the Pacific ocean, does not admit of doubt. The history of trade from the earliest records of time, furnishes no instance of a considerable movement of produce designed for human or animal food towards countries and populations adjacent to the Pacific ocean.

The Atlantic is a long narrow ocean, easily navigated on short voyages. The countries on either side of it are inhabited by the powerful Christian nations of the earth; nearly all of them com-

mercial, and most of them importers of grain. It is opened up to Northern Africa and to Southern Europe by the Mediterranean sea, and to Northern and Central Europe by the Baltic. It is opened to all America except the Narrow Strip west of the Andes, the Cordilleras, and the Rocky mountains, by our gulfs and seas, our bays and lakes, and by our great rivers, of which the Mississippi and the Amazon are scarcely more important than a dozen others. Nearly all the great navigable rivers of the world flow into the Atlantic and its tributaries.

Our Western grain must find its consumers in the populations near the Atlantic, and its markets almost exclusively in Atlantic ports. (Great Britain alone imports annually four millions of tons of grain.) It must all seek exit in the direction of the Atlantic; its natural tendency being to pursue the short direct route due eastward, from the localities of production to the seaboard. There is no reason for believing that this tendency will ever be reversed or changed.

*The East and West alike interested in the question of Cheap Transportation.*

The problem of providing cheap transit to the seaboard for the whole production of the West which can be spared for market, is not of first importance to producers alone. The entire manufacturing and commercial populations of the eastern states are interested in obtaining food. Unless food shall be furnished at the lowest prices, manufactures must gradually decay throughout the eastern and middle states, and either perish after a lingering existence, or migrate to other sections in search of cheap subsistence. The interest of the West in cheap transportation is no more vital than is that of the East in cheap food. Both are dependent upon the timely and liberal provision of adequate channels of transportation. Cheap food is the best "protection" which can be provided our manufacturers against foreign competition. It is in its relation to this subject that the commercial and manufacturing seaboard but reflects the prosperity of the West. Western products furnish the basis of commercial wealth, and cheap food is essential to the prosperity of every manufacturing community. Thus every great work which may be projected for cheapening and increasing transportation between the West and East is national in character, and merits the encouragement of the national government. ,

THE SECOND RESOLUTION.

*A Central Water-line now an exigent necessity of the West.*

II. The object being to provide means for transmitting the maximum quantity of produce at a minimum cost, your committee have no hesitation in recommending the opening of a canal and

slackwater line of continuous navigation across the territory of Virginia, from the Ohio to tidewater on the James river, as suggested by the second resolution submitted by your honorable body for our consideration. Since the introduction of the steam tug and barge system of transportation on the western waters, since the practice has become general of transporting grain in bulk, and since the application of stationary and movable steam elevators for transferring grain from one vessel to another, inland water transport—which at one time seemed likely to be wholly superseded by that of railway—has assumed new importance in the West, and has been made much cheaper than it is possible for railroad transportation to be rendered over long distances.

These improvements in the method of conducting the business of transportation on western waters, have given canals a revived importance and awakened a widely pervading interest in the proposition to open a continuous line of direct navigation from the Mississippi river to Hampton Roads through the territory of Virginia.

Your committee are more strongly inclined to look with favor upon this enterprise on account of the

*Superior capacity of Canals for carrying quantities of freight.*

To illustrate this truth we need but consider some of the special facts of transportation.

The boats used on the Erie canal carry 210 tons; that is to say, as many tons as a railroad train can carry of twenty-six freight cars, each bearing eight tons. The small capital invested in the canal boat, the small number of men employed to man it, and the small cost of motive power used in drawing it, are all in striking contrast with the capital necessary to be invested in the locomotives and freight cars, in the purchase of fuel, and in the hires of men attending the freight trains. The ratio of capital required in the one case and the other is as twenty to one. The canal, moreover, is a public highway, open to all. The railroad is necessarily operated by a corporation having large capital and all the attributes of a monopoly. In general the outlay of capital is ten times as great in the case of railroads as in the case of water transportation. When, therefore, we design to construct an additional outlet for the trade of the West, truly national in its character, in being open and accessible to the use of the humble as well as the great, of the poor as well as the rich, we must provide a water channel rather than a railroad. In a lecture delivered in February last, before the American Institute, by Professor Wm. J. McAlpin, the following striking comparison is made of the capacity of canals for transportation with that of railroads, and of the actual transportation of the Erie canal with that of all the trunk railroads in the United States:

"The great canals executed in our day form an important feature in this progress. With many persons there is an idea that the railway has superseded the canal, and that the former now performs the chief part of the traffic of the country. While the latter is true in regard to interior short lines of trade, it is a serious error, in reference to the great transport between the agricultural West and the Atlantic. The Erie canal, during the season of navigation conveys more of this traffic than all of the railroads together; more than all of the trunk lines from the St. Lawrence to the Potomac. The boats which come to tidewater have an average cargo exceeding that carried by the longest freight train on the Central railway. During the busy season more than 150 such boats arrive daily, and their tonnage would require more than 150 freight trains. The greatest number is but thirty per day on the Central railway. The Erie canal, therefore, is performing more than five times as much business as the Central railway. Yet the slow plodding canal boat attracts no attention, though burdened with more tons than the bustling, noisy, whirling freight train, which creates a sensation in every village through which it passes. The 4,000 canal boats of an aggregate of 1,000,000 of tonnage, moving 5,000,000 tons of cargo per annum, exceeds the tonnage of the vessels engaged in the foreign commerce of this city [New York] even before the war."

*Canals are used by the Public—Railroads only by their Owners.*

Here is also exhibited one of the many reasons why canals afford more unlimited capacity for the transportation of freights than railroads. Whoever may be able to command a few hundred dollars of capital may engage in the business of a common carrier on the canal; whereas that business on railroads is virtually confined to the single corporations owning them. If we are to have additional highways for the *cheap* transportation of *heavy* produce in great *quantities*, we must open at least another canal which should be at the service of all common carriers, great and small.

The Erie canal, in its present dimensions, is adapted to boats carrying 210 tons. Its capacity is now theoretically equal to the discharge of 7,000,000 of tons of produce per annum way and through, it actually discharges less. It practically passes as much tonnage during the year as three of the most efficient and best appointed railroad lines of the world. During the seven months when it is open, it discharges as much tonnage as five such railroad lines. It carries bulky articles of commerce, which the railroads cannot move with profit, and it carries all produce cheaper than the railroads. The Hon. Israel T. Hatch of Buffalo, a high authority on these subjects, said recently in an address to a meeting of leading merchants in the city of New York:

"The average cost per ton from Chicago to New York via the lakes, the Erie canal, and the Hudson river, including canal tolls and carriers profits, embracing a period of ten years, is \$7 60 $\frac{1}{2}$ . The

cost of transportation on the Central railway, as given in annual reports, taking the average for six years, is one cent four mills and nine tenths of a mill per mile, not including carriers profits. This average applied to the distance from Chicago to New York by rail, 988 miles, makes, \$14 31 per ton, or \$6 65 more per ton than the average cost for a period of ten years via the lakes, the Erie canal and the Hudson river, including state tolls and profits of carriers. The through freight moved eastward by the five trunk lines and the Erie canal is about, in round numbers, 5,500,000 tons, which, if multiplied by \$6 65, the difference before mentioned, would make a difference between rail and water transportation of all carried by either method of \$36,580,500 and with the profits of the railway companies added to the actual cost, would augment this amount largely."

The classes of freight chiefly carried by the canals are the heavier products of agriculture and those of the forest and the mine. The New York canals carried in 1867, of the products of the forest 1,232,968 tons, valued at \$11,167,969, while the amount of this class of products carried by all the railroads of the state in the same year was only 303,236 tons, having a value of only \$2,204,526. In respect, however, to articles of higher value, the case was reversed, the railroads of the state having carried 1,290,815 tons of "animal food," valued at \$440,916,588, while the canals carried only 16,614 tons, valued at \$5,675,202. Thus railroads and canals supplement each other, the canals relieving the railroads of cumbersome products paying low freights, while the railroads carry those articles which could not await the slow transit of the canals and which afford high charges of freight.

Railroads do not afford cheap transportation for great distances. The canal, the river, the lake, are the channels for the products of the farm, forest and mine, the railroad is for merchants and manufacturers.

It may be conceded that canals do not stimulate the production of the countries which they penetrate as actively as railroads. But when once a net work of railways is constructed, and has produced that vast augmentation of production which in fertile regions invariably results, then canals become indispensable aids to railroads in taking off to distant markets the increased and increasing production. In order, therefore, to solve the problem of cheap transportation and adequate means of outlet for western produce, we cannot confine ourselves to any one species of improvement. We must have a sufficiency of all improvements, and more especially of canals, as they have greater capacity for the transportation of *quantities* of freight than railroads, and can carry *heavy* produce cheaper over *great* distances.

*Canals are not obsolete.*

That canals have not become obsolete is proved by the fact that

in France there are in profitable operation 7,700 miles of canal and slack water navigation; and that in Great Britian and Ireland there are over 4,000 miles of similar works in use as follows:

Canals—England	2,600 miles.
"    Scotland	225   "
"    Ireland	275   "
Navigations	900   "
	_____
	4,000   "

In France, where the system has greater extension than in any other country, the emperor, not content with mastering the Suez canal, has projected a great ship channel from the bay of Biscay to the Mediterranean, the cost of which is estimated at between seventeen and eighteen millions of pounds, and the time necessary for its completion six years.

The argument against the utility of canals, and the trite assertion that they have become obsolete, were based principally on the fact that in the United States some canals have been unsuccessful and some have been virtually abandoned.

The great success of canals in Great Britian created a furor for their construction in this country, and many were made that proved to be failures, principally because the zeal that projected and commenced them died out before their completion, and the prosecution of the works was abandoned before they had arrived half way to their destination.

Another cause of their want of success was that many of them were made of such small dimensions that they could not be profitably navigated, and soon filled up, so that they could not be navigated at all. But these failures prove nothing, and are only warnings against the folly of wasting money on works that never can, or never will, be completed, and against projecting great water communications upon such mean and insufficient plans that their very littleness will insure their failure.

The partial obscuration of canals by the dazzling success of railroads has been only temporary, and so far from public opinion being against canals, it is now settling strongly in their favor, and their utility and their superiority over railroads for the cheap transportation of heavy tonnage is a growing opinion, and the necessity for their construction, not as rivals but as reliefs to railroads, is more and more generally conceded. This is manifested by the earnest demand at the North for the further enlargement of the Erie canal to the capacity of vessels of 500 tons; by the projection of new lines of water communication and the enlargement of old ones, in Canada, where \$200,000,000 are proposed to be expended upon such works; by the proposed ship canal around the Falls of Niagara; the enlargement of the Illinois and Michigan canal to ship dimensions; the proposed ship canal from Lake Michigan to Lake Erie; another across the Isthmus of Florida, to shorten the voyage and avoid the difficulties and dangers of the Florida Pass; and

lastly the magnificent scheme of connecting the Atlantic and Pacific oceans by means of a ship canal across the Isthmus of Darien. No less than nineteen different routes have been proposed for a ship canal across the American Isthmus, and various surveys have been made by governments and private individuals, and the interest in this interoceanic connection is unabated. Mr. F. W. Kelly of New York has estimated the saving in money to the trade of the United States that would result from the use of the Isthmus canal, at \$36,000,000; and the saving to the trade of the world at about \$50,000,000, annually; while the cost of the canal has been estimated as high as \$325,000,000.

In comparison with this gigantic scheme, the Virginia water line only dwindles into insignificance so far as the cost is concerned; but when we come to consider the benefit to be derived from it in the saving of money to the trade of the United States, it will be seen that at one-eighth the expenditure in money the saving will be as great.

The interest in canals is not confined to the United States. One of the leading topics of the world at this time is the successful completion of the great Suez canal, at a cost of \$80,000,000. The French emperor's plan of connecting the bay of Biscay with the Mediteranean, in order to save the circuit of the passage of Gibraltar, excites great interest and commands favor. The canalling of the isthmus of Corinth is also projected, as well as the important project of connecting the Baltic and North seas by a canal across the isthmus of Denmark.

What greater evidence could there be of the public estimation of the value of canals than the projection of the above mentioned schemes, especially those in New York and Canada, where the period of navigation is limited to seven months in the year? What railroad could live and prosper if its operations had to be suspended for five months every year?

The principal concern that needs be felt for the success of the Virginia water line is, that the full benefit to be derived from its unrivalled position and advantages may not be attained from parsimony or an unwise economy in the scale of its construction. If made at all let it be made on a scale commensurate with the demands of the trade of the great West, and fully up to the greatest capacity that can be obtained at the summit level. It is the opinion of the engineer of the company that a capacity double that already assumed in his plan of the canal, or say for boats of 500 tons, could be obtained by the construction of reservoirs on the Greenbrier and its tributaries.

*The existence of Natural Channels has never been held an argument against the construction of Artificial ones.*

In the United States there would be a blockade of western trade if the Erie canal were closed for a year. It is idle to urge in oppo-

sition to the project of cutting a canal straight across the country from the waters of the Ohio to those of the Chesapeake, that the Mississippi river and the gulf are competent to bear away all the produce which the West can grow, and which the Erie canal and the great railroad lines across the Alleghany summits cannot move. If they are competent to the task they do not actually perform it; simply because the river and gulf route is too circuitous to be pursued by the produce of a very extensive region of the country contributing its trade; and the northern water route is closed by ice for five-twelfths of each year.

If, in 1665, an engineer of the Spanish monarch, sitting on the ramparts of Gibraltar, had ridiculed the attempt of Louis the Great to transmit trade from Toulouse to Marseilles without having to pass under the guns of that fortress, and had asked: "What need of a canal across France, while these straits remain here, capacious enough to pass the commerce of all the world at once?" he would have spoken in the spirit of those who now object to the Virginia work. But the canal *du Midi*, with its great reservoir of St. Ferrol, was built, and it still exists, one of the most valuable works of France, and one of the proudest monuments of the genius of Louis XIV., and the advanced enterprise of the seventeenth century. One hundred years afterwards, ignorant of what had actually been done for a whole century in France, a very "practical" public in England, ridiculed the project of the Duke of Bridgewater to make an artificial navigation from Liverpool to some coal mines only forty miles distant through a flat country. But the Duke's name now stands amongst the most renowned and most revered in England, and the practical British public has since attested its appreciation of the works he inaugurated by constructing three thousand miles of canals, which are in daily use. And yet, one hundred years since the triumph of the Duke of Bridgewater over all ridicule and all protestation, and two centuries since Louis XIV. proved that the straits of Gibraltar were not sufficient to answer all the purposes of French navigation, the idea is still maintained by a few that the Mississippi affords the only needful outlet for Western trade. But distance has something to do with the operations of commerce, and a very large portion of the western produce, rather than travel three thousand miles, from St. Louis to New York, by way of the Balize, the Gulf and the long southern coast—going out of the country, in order to get through it—would prefer a short trip of only fifteen hundred miles inland to Norfolk, even if, in the passage through the Virginia canal, it would have to scale seventeen hundred feet of elevation, or about half as many feet in lift of locks, as it would go extra miles in tedious circuit by way of the Balize, Cuba and the Bahamas.

The cheapest transit for long distances is furnished alone by water; and yet, in order to get to the seaboard at present by water, western produce must needs go either by the lakes or by the gulf, must go beyond the boundary of the Union for want of a direct

navigation across the territory of the Union. This is a national shame, a national inconvenience, a national loss. Another canal is needed for the millions of tons of western produce which is now not carried to market at all, simply because the rates of charge for transit are not cheap enough to draw it out from the far interior. General Washington suggested the true remedy for this now great and growing evil. The remedy was a *line of unbroken navigation across the territory of Virginia.*

*Causes which have impeded the opening of this line.*

The fact that this route of navigation has not been opened long ago, especially in view of the successful experience of New York with the Erie canal, furnishes no argument against the present expediency of the enterprise. The delay has been due both to physical and financial causes. It is a fact that Virginia formed the determination to construct a canal across the mountains in her territory, at about the same time that New York began to make a canal across the level plateau of country which stretches out between the Hudson and Niagara rivers. The task of New York was as easy as that of Virginia was difficult. The surface of Lake Erie is only five hundred and sixty-four feet above tidewater, and, except the elevation forming its eastern shore, is higher by 143 feet than any of the ground between the lake and the Hudson river. Between the Seneca and the Mohawk rivers, a plateau of country extends for sixty miles, along which not a single lock was required in constructing the canal. Nothing was needed to be done, in fact, but to cut through the eastern shore of the lake, and lead the outflowing waters down along a gradually descending country to the sources of the Mohawk, and with the course of that stream to the Hudson. So favorable was the topography of the route that the cost of making this channel, three hundred and sixty-three miles long, was estimated at only \$5,000,000, and did not actually exceed \$7,000,000, on the plan on which the canal was first completed. No sooner did trade begin to find an artificial outlet from Lake Erie to the Hudson, than canals across the low divides between the waters of Lake Erie and the Ohio, and Lake Michigan and the upper Mississippi, were undertaken. It required lockages of only five hundred and sixty-nine feet to reach the elevation of Lake Erie from the Hudson; between Lake Erie and the Ohio, the elevation to be surmounted was only nine hundred and fifty feet; while that between Lake Michigan and the Mississippi was only six hundred and ten feet. New York plainly saw that, by first constructing her own canal, and then aiding the states of Ohio, Indiana and Illinois in constructing other canals over these easy summits, she would obtain command of the trade of a country embracing half a million of square miles, as fertile as the Delta of the Nile. While New York had only these three inconsiderable summits to surmount, in order to reach beyond the lakes to the Mis-

sissippi and the Ohio; what were those which Pennsylvania, Maryland and Virginia had to overcome in simply reaching the Ohio? Pennsylvania had a range of mountain country seventy miles in breadth to penetrate with her canal, and a summit of one thousand eight hundred and ninety-nine feet to surmount with locks. Maryland had a series of mountain ranges a hundred miles broad to traverse, and a summit level of three thousand seven hundred and fifty-four feet to lift her canal over. Virginia had a like series of elevations, a hundred miles in breadth to cross, and a summit of 1700 feet to overcome.

Yet nothing daunted by barriers which would be appalling even to the enterprising spirit of our own time, these states went boldly forward with their respective canals. Pennsylvania spent \$20,000,000 in making a water line, broken by inclined plains and pieced by portages. Maryland, aided by Virginia, spent eight millions of dollars on the Chesapeake and Ohio canal, in carrying it no further than the foot of the Alleghanies, and then, dismayed by the difficulties still before her, gave up the water line and devoted her resources to the Baltimore and Ohio railroad. Virginia undertook her canal as courageously as the rest; and after spending \$10,000,000 found she had carried it only to the western base of the Blue Ridge. The works in which these three states had been engaged were so arduous, expensive and tedious, that before they could be completed the growing preference for railroads, and the success of those works, produced a division of popular sentiment on the subject of the proper improvements to be constructed, and caused a suspension of the canals. Owing to the favorable route enjoyed by New York, and the rapidity with which the Erie canal was constructed, New York had completed her great work before the popular preference for railroads had supervened to suspend that work. She pushed it through to early completion; secured, also, the construction of the Ohio and Illinois canals; and thus completed a grand system of inland navigation reaching more than a thousand miles into the heart of the West, before being called on to embark in railroad enterprises.

Pennsylvania, Maryland and Virginia were forced to change their system of improvements after having crippled their finances on unfinished canals, and to engage in the construction of railroads, without the aid of the trade which had been expected from the canals.

#### *Merits of the Central Water-line.*

The junction of the Ohio and the Mississippi rivers is the grand converging point of the Kansas, Nebraska, Missouri, Mississippi, Illinois, Ohio, Cumberland and Tennessee rivers; is the geographical centre of their trade, and the converging and diverging point of seventeen thousand miles of inland steamboat navigation; whilst Norfolk, the central and most capacious harbor of the Atlantic coast, is connected with the centre of the vast interior (ex-

cept the little space occupied by the "unfinished section" of the Virginia Canal) by an unbroken water-line, which is at once shorter, cheaper and more reliable than any other, and open to trade for more than eleven months of the year. It would seem that these two great centres were made expressly for each other.

For many years the cheapness of transportation on the Erie canal gave a permanently north-eastward tendency to the trade of the whole West, above the parallel of St. Louis. But the perfection to which railroad construction has been brought, and the increasing cheapness and rapidity of railroad transportation have given to western trade a strong and growing tendency to cross the country on lower latitudes and shorter routes. Hence the vast business that has sprung up on the Pennsylvania roads, on the Baltimore and Ohio road, and on the Norfolk and Memphis line of road.

The growing preference of western trade is for central lines; not only because they are more exempt from the frosts of the northern climate, but because they are on the shortest routes from the centres of western production and population, to the centre of the American seaboard. It is this tendency of trade, it is this necessity of trade, that has so powerfully turned public attention of late to Norfolk as a great seaport city, and given so much credit to the lines of improvement proposed for connecting the great Virginia seaport with the leading cities in the central West.

### *The Great Harbor of Norfolk.*

In respect to the advantages of Norfolk in its central location upon the seaboard, and the superlative excellence of its harbor, the highest authority in maritime and commercial subjects, Commodore M. F. Maury, better known to science as Lieutenant Maury, is here quoted. That eminent author says:

"Geographically considered, the harbors of Norfolk or Hampton Roads and New York occupy the most important and commanding positions on the Atlantic coast of the United States. They are more convenient to the ocean than Baltimore, Philadelphia and Boston are, because they are not so far from the sea.

"Depth of water that can be carried out, and distance of the sea from

Hampton Roads, distant	15 miles—depth	28 feet.
New York,	30 "	3½ fathoms, 23 feet.
Boston,	100 "	3½ " 21 "
Philadelphia,	100 "	3½ " 23 "
Baltimore,	160 "	2½ " 16 "

"Between the three last and the sea there is a tedious bay navigation, but each of the first two is situated upon a well sheltered harbor, that opens right out upon the sea with beautiful offings, those of Hampton Roads surpassing the others in all the requirements of navigation, both as to facility of ingress and egress, certainty of land fall, depth of water, and holding ground.

"The Chesapeake bay is a "king's chamber" in the bosom of

Virginia, which no belligerent may enter with other than good intent. It affords the finest harbors on the coast; and, moreover, they are those farthest to the north on the Atlantic side of the continent, that are never obstructed by ice.

"To the south, all the seaport towns, as far as the Reefs of Florida, have their harbors obstructed by bars, over which the larger vessels of commerce can never pass; and the extent of back country, naturally tributary to them, is, in comparison with that which is tributary to the seaport towns of Chesapeake bay, very small. It does not extend beyond the drainage of these rivers.

"The harbors that lie north of the Chesapeake are liable to obstructions by ice every winter, and their approaches are often endangered by the fogs which prevail in their offings.

"This noble sheet of water, with its spacious harbors, is large enough to accommodate shipping sufficient to afford transportation for all the products and merchandise of the West, were they a thousand fold more abundant than they are; and it is the most convenient point on the entire coast for distributing them north and south along the Atlantic seaboard, or for sending them to markets beyond the sea.

"As to the natural advantages of position, depth of water, and accessibility by land and sea, *Norfolk has no competitor among the seaport towns of the Atlantic.* Midway the Atlantic coast line of the United States, Norfolk is the most convenient because the most central point where the produce of the interior may be collected; and whence it may be distributed, north and south, right and left, among the markets of the seaboard. Its climate is delightful; it is exactly of that happy middle temperature where the frosts of the north bite not, and where the pestilence of the south walketh not. Its harbor is commodious, and as safe as can be. It is never blocked up with ice, and as to the egress and ingress between it and the sea, it possesses all the facilities that the mariner could desire.

"Moreover, the prevailing winds in the parallel of Norfolk are westerly winds, which are fair for coasting and for going seaward in any direction. A little to the south of that parallel you find the northeast trades, which are fair winds for the inward bound Norfolk vessels.

"Then there is the gulf stream, that mighty river in the ocean, upon the verge of which Norfolk stands.

"It flows up with a current which, without the help of sweeps, sails or steam, will carry the European bound vessel out of Norfolk at the rate of nearly one hundred miles a day, directly on her course. Then at the sides of this, and counter to it, are eddies which favor the same vessel on her return to Norfolk. These *hawse* her along and shorten her voyage by many a mile.

"Such are the natural advantages of Norfolk seaward. Let us look ashore and consider them landward, and compare them with the natural inland advantages of New York. Stretch a string on the map from Norfolk to New York and make a dot half way be-

tween them. Now seek a point on the south shore of lake Erie that is equidistant from New York and Norfolk; draw a line from the dot to this point, and you will have a dividing line of distance between the two places, every point along which will be just as far from the one place as the other. You will find that this line runs through Delaware and cuts lake Erie near Cleveland, Ohio.

"Thus you perceive that Chicago, in Illinois, and St. Louis, Missouri, are actually nearer to Norfolk than they are to New York, even by an air line.

"You see, moreover, that as between New York and Norfolk, the natural advantages here are greatly in favor of the latter.

*"The most direct way to the sea through either of these ports, from most of the lake country, and from almost the entire Mississippi valley, lies through Virginia."* The natural advantages, then, of Norfolk in relation to the sea, or to the back country, are superior beyond comparison to those of New York."

In his great work, entitled "*Physical Survey of Virginia*," Commodore Maury further says in regard to the military advantages of Norfolk:

"Moreover, the approaches from the sea to Sandy Hook and to the Chesapeake are greatly in favor of the latter. In war, lighthouses would be extinguished, and all lightboats, beacons and buoys removed. The channel way to Sandy Hook is narrow and intricate, so that a vessel flying from a superior force in war, to seek protection under the forts or shelter in the harbor, would run great risk of stranding. On the other hand, the entrance to the Chesapeake is wide, open and clear; ships can run in there by night as well as by day, and in all weathers.

"Sandy Hook is hydrographically very easy to blockade, the Chesapeake difficult. The offings of Sandy Hook are sheltered on the North and West, forming a lee under which blockaders may find shelter from all gales coming from either of these two quarters of the horizon.

"At Sandy Hook the blockaders would have to watch a ship channel way only 900 yards wide. The entrance to the Chesapeake is as wide as the distance (9 miles) between the capes of Virginia. The coast from Hatteras to Henlopen is rigid and inhospitable, offering neither shelter nor refreshment to an enemy in distress."

Between such a system of navigation as that which centres about the mouths of the Ohio and Missouri, and a harbor so central, so spacious, so accessible, and so convenient for the trade of the land and of the sea as Norfolk, situated due east, on the shortest route from the commercial centre of the West, it would seem that there ought to be opened a direct line of navigation. No where on the face of the earth are two such vast systems of navigation brought into as close proximity as those afforded by the waters of the Atlantic and by the rivers of the Mississippi valley, which almost touch each other on the territory of Virginia.

Nature has performed the maximum of the labor required for uniting them, and left art to perform the minimum. The problem is, simply to extend the channel of the Ohio, or rather of the Mississippi, thirty miles eastward toward the Chesapeake, so that the Mississippi may, as to its navigation, empty by the shortest passage into the Atlantic. The union of two such vast navigations would justify the expenditure of hundreds of millions of dollars.

*Distances of Trade Points in the Interior from different Markets.*

Commodore Maury, in his *Physical Survey of Virginia*, furnishes the following table of distances from leading commercial centres in the West, by important routes, respectively, to New York and Norfolk:

## "COMPARISON OF WATER ROUTES AS TO LENGTH."

FROM	To New York via Lakes.	To Norfolk via James River Canal.	Difference in favor of Norfolk. MILES.
	MILES.	MILES.	
Fort Benton .....	5,012	4,673	339
Omaha .....	2,712	2,373	339
Kansas City.....	2,368	2,029	339
Mouth of Missouri river.....	1,912	1,573	339
Mouth of Illinois river.....	1,889	1,596	293
St. Paul.....	2,637	2,344	293
St. Louis.....	1,932	1,553	379
Mouth of Ohio river.....	2,132	1,353	779
Memphis.....	2,382	1,603	779
Louisville.....	2,519	966	1,553
Nashville.....	2,397	1,498	899
Cincinnati .....	2,661	824	1,837
Wheeling.....	3,043	778	2,265
Pittsburg.....	3,137	872	2,265
	Via Gulf		
St. Paul.....	4,014	2,344	1,670
St. Louis.....	3,223	1,553	1,670
Cincinnati .....	3,552	824	2,728
Louisville.....	3,410	966	2,444
Pittsburg.....	4,028	872	3,156
Wheeling .....	3,934	778	3,156
Nashville.....	3,288	1,498	1,790
Mouth of the Ohio.....	3,023	1,353	1,670
Memphis.....	2,798	1,603	1,195

This author indulges in the following striking comments upon the facts developed by these tables:

"These figures reveal the fact that as between New York and Norfolk, Norfolk is not only the nearest Atlantic seaport to the great valley of the West, but that (the Virginia water line) would open a shorter and cheaper route to New York than either the lakes or the gulf now afford from any place between New Orleans and

St. Paul, and from Fort Benton to Mobile. The distance from Norfolk to New York is 279 sea miles. And Norfolk by the proposed route, will be 293 miles nearer than New York is by present routes, to all places on the Mississippi river that are situated above the mouth of the Illinois river. When we come below that, and get on the Ohio, then the flourishing cities on both sides of that river will be 1000 to 1500 miles nearer to New York via Norfolk, than they are via the lakes. This Virginia route will bring all places on the Mississippi river above Memphis, and all places on the Missouri and its tributaries, nearer to Norfolk than they now are via river and gulf to New York, by more than 1600 miles, and they will bring all the landing and river towns on the Ohio from 1700 to 3100 miles nearer to Norfolk by water than they now are by river and gulf to New York."

*Relative merits of the three Water Routes.*

The desideratum being to carry the largest possible quantity of freights at the cheapest rates, the necessity of an additional canal on the shortest and most direct route, connecting the vast system of navigation in the West with the waters of the Atlantic, not in lieu of railroads, not in competition with them anywhere, but in addition to and in aid of them, has been already shown. At present there are no means of water outlet for the produce of the great interior of the continent except by way of the Belize, the gulf and the Florida Pass on one hand, and by way of the lakes and the Erie canal or the St. Lawrence river on the other.

The efficiency of the northern lake and canal route is impaired by two circumstances. The first of these is that the route is closed by ice for five-twelfths of the year, the closing taking place before the wheat of the interior country can be moved to market, and before the corn is sufficiently matured and dry to be shipped. The second is, that vessels suitable for the navigation of the Erie canal cannot weather the storms of the lakes—a circumstance which involves the necessity of two transhipments. The equinoctial storms which endanger the navigation of the lakes in September and October set in just as the wheat of the interior begins to move towards market.

The efficiency of the southern route by the lower Mississippi, the gulf and the capes of Florida, is impaired by several circumstances. The navigation of the gulf is unsafe by reason of frequent and sudden storms, and the passage of the capes of Florida is extremely dangerous from the presence of hidden reefs of rocks. Pilotage on the lower river and insurance upon the gulf voyage impose heavy taxes upon all produce passing out from New Orleans.

Not to dwell invidiously, however, on other disadvantages belonging to these two routes, which art and enterprise may succeed in removing, the great irremediable objection to both of them is, the circuitous distances which they require western trade to pass over on

its way to market, coupled with the misfortune that neither of them lies wholly within the jurisdiction of the United States. The distance of St. Louis from New York is 1,932 miles by way of the lakes, and 3,223 miles by way of New Orleans and the gulf. They lie along either extremity of then ational territory, and require the great bulk of interior production to move around the extremities of the country, instead of moving directly across it. If, however, there were opened a direct line of water transportation from St. Louis to Norfolk, the distance to be traversed by western trade in reaching the best port of the Atlantic would be only 1,553 miles.

*History of the James River and Kanawha Improvement.*

We come now to speak specially of the James River and Kanawha canal of Virginia, the completion of which is now proposed, and has become an object of a most lively and pervading public concern.

The idea of a communication by a public highway between the valley of the Ohio river and the valley of the James river, is supposed to have originated with General Spotswood when, on the 20th of August, 1716, he set out from Williamsburg on his expedition over the Blue Ridge. The first suggestion, however, of a through line was from Rev. James Maury, in a letter dated January 10th, 1756. It was reserved to General Washington, however, after his expedition to the West, in 1753, to bring the subject prominently forward, which he did by urging upon the governor and council of Virginia the importance, as well for commercial as for military purposes, of a connection between the East and the West. This scheme he cherished during the remainder of his life. In 1770, 1772 and 1774, he made tours of examination with a view to supply himself with facts which would enable him to show the feasibility, expense and advantages of the connection. In a letter to Mr. Jefferson, 29th March, 1784, he informs him that he had been long impressed with the importance of a communication between the waters of the Ohio and Potomac; that he became the principal mover of a bill in the General Assembly, of which body he was then a member, to empower a number of subscribers to undertake, at their own expense, the extension of the navigation of the Potomac from tidewater to Wills's creek, a distance of about one hundred and fifty miles, with a portage between it and the streams capable of improvement which run into the Ohio. He repeatedly referred to the same subject afterwards, and seems to have been as profoundly interested in it as De Witt Clinton afterwards was in the New York and Erie Canal. He urged the matter upon Governor Harrison, father of President Harrison, who communicated the subject in a message to the legislature October 18, 1784. General Washington visited the legislature in person to confer with the members upon a plan of internal improvement; and on the 15th December, 1784,

James Madison, chairman of a committee appointed for that purpose, reported a bill for opening and extending the navigation of James river, which became a law January 5, 1785, and was signed on that day by the speaker, John Tyler, father of President Tyler. These facts show that this great improvement was the conception of the wisest, most practical and far seeing minds of Virginia.

This organization continued until the 17th day of February, 1820, on which day the legislature passed an act to amend the "Act for clearing and improving the navigation of James river, and for uniting the eastern and western waters by the James and Kanawha rivers." By this act the rights and interest of the James river company were transferred to the commonwealth, and by an act passed February 24th, 1823, all the rights, power, duties and privileges of the president and directors were conferred on the board of public works, whose transactions were to be still in the name of the "James river company." This organization continued until the year 1835.

The old James river company constructed a canal around the falls of James river, extending from the city of Richmond to Westham, a distance of about seven miles, and improved the bed of the river by sluices as high up as Buchanan.

The *second* James river company, on state account, enlarged and reconstructed the former canal from Richmond to Westham, and extended the same to Maiden's Adventure, in Goochland county, a distance of 27 miles; constructed a canal through the Blue Ridge seven and a half miles long; constructed a turnpike road from Covington to the mouth of Big Sandy river, two hundred and eighty miles long, and improved the Kanawha river by wing dams and sluices from Charleston to its mouth, a distance of 58 miles.

The *James river and Kanawha company* was incorporated March 16th, 1832, and organized May 25th, 1835. By the charter the whole interest of the commonwealth in the works and property of the then existing James river company was transferred to the James river and Kanawha company; the state being interested in the latter to the extent of three-fifths of its capital stock, and individuals and corporations to the extent of the remaining two-fifths.

The construction of the new canal from Richmond to Lynchburg was commenced in 1836, and the work was completed about the first of December, 1840.

In that time the work of construction of the second division of the canal above Lynchburg was commenced, and prosecuted up to the year 1842, when, for want of funds, it was abandoned. On the 1st of March, 1847, an appropriation of \$1,246,000 was made by the legislature for the purpose of completing the unfinished work between Lynchburg and North river, and the extension and completion of the canal to Buchanan.

The work was commenced in July, 1847, and completed in November, 1851.

Fifteen miles of the 3rd division of the canal, next above Buchanan, was put under contract in August, 1853, but for want of funds the work was suspended in the fall of 1856. The work done on this portion of the line consisted chiefly of stone locks, aqueducts and tunnelling.

The original capital of the company was five million dollars, of which the state paid one million in old works, and of the private subscription there proved to be insolvent \$73,336, leaving \$3,926,664 as the actual available cash capital. All beyond the capital thus realized, has been money either borrowed directly from the state treasury or on bonds guaranteed by the state, on which the company has been required to pay interest from the day it was received, before it was expended, and of course long before it began to yield any return.

The actual cost of construction of the James River and Kanawha canal, including the incomplete works above Buchanan, has been \$10,436,869.

To relieve the company from its embarrassment and to enable it to complete the canal to Covington, the legislature, on the 23rd of March, 1860, passed an "act to amend the charter of the James River and Kanawha company, by which the capital stock of the company was increased to twelve million four hundred thousand dollars, in shares of one hundred dollars each, and the board of public works was directed to subscribe on behalf of the commonwealth, in addition to the shares now owned by the state in said company, for seventy-four thousand shares of said capital stock, which shall be declared by said company a six per cent. preferred stock, on which six dollars per share shall be paid to the holders thereof, before any dividend shall be paid on other stock of said company; whereof seventy-two thousand shares shall be taken in full satisfaction of the debt now due from the said company to the state, and for the assumption by the state of the debt for which the state is bound as the surety for said company, and the annuity to the old James river company; and for the residue of two thousand shares, the bonds of the state for the aggregate amount of two hundred thousand dollars are to be delivered to the company, to be applied to the extinguishment of the floating debt of the company.

On the first March, 1867, the legislature of Virginia passed an act authorizing the James River and Kanawha company "to borrow the sum of seven hundred and fifty thousand dollars, to be applied to paying off the floating debt of the company, putting and keeping its present works in repair, and to give a mortgage on the property, franchises and net revenues of the company, for the purpose of securing such loan." This loan has been effected.

The capital stock is at present held as follows:

Commonwealth of Virginia,	104,000 shares.
City of Richmond,	5,768 "
City of Lynchburg,	673 "
Washington college,	100 "
Individual stockholders,	13,459 "

*Description of the Virginia Water Line.*

The Virginia water line extends from tidewater on James river at Richmond, to the Ohio at Point Pleasant, the mouth of the great Kanawha, a distance of 482 miles, and consists of the following completed and unfinished works:

1st. The Richmond dock and tidewater connection (completed),	1.00 mile.
2d. The first division of the canal, extending from Richmond to Lynchburg (completed),	146.50 "
3d. The second division of the canal, extending from Lynchburg to Buchanan (completed),	50.00 "
4th. The third division of the canal, extending from Buchanan to Covington (partially constructed),	47.00 "
5th. The fourth division of the canal, extending from Covington to the Greenbrier river (not yet touched),	29.33 "
6th. The Greenbrier and New rivers to Lyken's shoals on the Kanawha,	123.21 "
7th. The Kanawha river from Lyken's shoals to the Ohio river,	85.12 "
	—
	482.16 "

The different forms of navigation on this route are thus distributed:

Two hundred and eight miles of slack water navigation from the Ohio to Howard's creek, a branch of the Greenbrier.

Forty-two and three-fourth miles of slack water at intervals between the Greenbrier river and Richmond.

Two hundred and thirty-four and a quarter miles of canal navigation. There are also 125 miles of river navigation from Richmond to Norfolk.

*Cost and plan of the Work.*

In his report on this subject, Mr. Lorraine, the engineer of the James River and Kanawha Company, speaks as follows of the plan proposed for completing the line, and of the portion of the work now in use:

"I have provided for a canal from Buchanan to the Greenbrier river of the same dimensions as the enlarged Erie canal, viz: 42 feet wide at the bottom, 70 feet at the water surface, and with a depth of water of 7 feet; the locks to be 120 feet long between the gates, and 20 feet wide.

"The locks will admit boats about 108 feet long and 19 feet wide, with six feet draft of water; such boats will carry at least 280 tons; but I will put the average loads at 250 tons.

"I propose to establish the summit at a level 1700 feet above tide, or twenty feet above the level of the Greenbrier river at the mouth of Howard's creek, and pass through the Alleghany mountain by

a tunnel about nine miles long. We would thus, by feeding directly from the Greenbrier river, be enabled to pass the summit level without the aid of reservoirs.

"I have provided for a tunnel 56 feet wide, and 32 feet high, with a waterway 44 feet wide, and a tow-path of solid mortared masonry on each side six feet wide, so that boats drawn by horses can pass each other without inconvenience; but these tow-paths may be dispensed with, and the tunnel excavated to its full width of 56 feet, may be navigated by steam tugs towing the canal boats through it.

"This tunnel, with the favorable character of the mountain for the location of *numerous shafts*, and the facilities which the late improvements in automatic machine drilling have afforded for the rapid prosecution of that kind of work, could be completed probably as quick as the rest of the work [say in 4 years.] On the line of the short tunnel, as located, there are three depressions in the mountain at which shafts may be sunk, one 129 feet, one 264 feet, and one 215 feet deep, or three shafts in  $2\frac{1}{2}$  miles, averaging 203 feet deep.

"The estimate for the Greenbrier and New rivers is for steamboat navigation, with stone dams and locks, the locks to be 200 feet long and 40 feet wide, with 7 feet depth of water; extending to Lyken's shoals on the Kanawha, where sluice navigation will begin.

"As it would be useless to construct the canal from Buchanan to the Ohio river, on an enlarged scale, without making a corresponding increase in the size of the locks, and in the depth of the canal from Richmond to Buchanan, I have made an estimate of the cost of building new locks  $120 \times 20$  by the side of the old ones, and of increasing the depth of the water in the canal to 7 feet."

The cost of enlarging the present canal, of completing it to the Greenbrier river on the enlarged scale, and of improving the navigation of the Greenbrier, the New and the Kanawha rivers, on the scale thus described, is given by the engineer at \$37,363,911. The capacity of the canal thus enlarged for transmitting tonnage will be measured by the capacity of the great tunnel on the summit level and of the locks approaching it. This capacity is thus stated by Mr. Lorraine.

"The boats will carry, in fact, 280 tons; but I will put the average loads at 250 tons, and will suppose that one boat will pass through the locks in every  $7\frac{1}{2}$  minutes, or 192 boats per day for 300 days, and obtain 14,300,000 tons as the actual capacity of the canal with a full trade. It would be fair then to assume the half of this sum, or say 7,000,000 tons, as the probable tonnage."

The theoretic capacity of this canal will therefore be fourteen millions of tons, its actual capacity at least seven millions.

The plan of construction and enlargement, thus described and devised by Mr. Lorraine, is approved and commended by Mr. B. H. Latrobe, one of the highest authorities on such subjects; as also by Major General Charles P. Stone, late of the United States army. General Stone, in a letter published in a document of the

James River and Kanawha Company, says of the long tunnel proposed by Mr. Lorraine: "The plan requires the following operations:

"1st. The driving of a tunnel nine miles long, or, in effect, *nine tunnels*, each one mile long, 56 feet wide, and 32 feet high.

"2nd. The construction of a strong, perfect dam across the Greenbrier river to make it sure as a feeder.

"Of the above nine tunnels Mr. Lorraine proposes to drive seven, each between two shafts 12 feet in diameter. Two between a shaft at one end and a thorough cut at the other.

"As regards the feasibility of the succession of tunnels, I think there can be no question.

"By the sinking of eight shafts, the matter is reduced to the driving of nine tunnels, each one mile long, so that it is really a question at each point of driving a mile of tunnel. More than that has been done in Virginia, and can be done again.

"As to the feasibility of the dam across Greenbrier river, I suppose no one will hold that to be either impracticable or even a difficult operation."

#### *Financial Promise of the Work.*

With reference to the financial promise of this line of navigation, Mr. Lorraine presents the following estimates:

Capital invested in new works, say.....	\$40,000,000
" " " old " "	4,926,664
Preferred six per cent. stock of the state.....	7,400,000
Total capital invested.....	\$52,326,664

#### PROBABLE REVENUES.

7,000,000 tons through freight, 485 miles @ 2 mills per ton per mile.....	\$6,790,000
100,000 " way " , say 50 miles @ 1 cent per ton per mile.....	50,000
200,000 " to and from Lynchburg, 146 miles @ $\frac{1}{4}$ cent per ton per mile,	219,000
100,000 " to and from Buchanan and Lexington, 196 miles @ $\frac{1}{2}$ cent per ton per mile.....	98,000
200,000 tons to and from Covington, 243 miles @ 4 mills per ton per mile,	194,400
300,000 " coal from Kanawha valley to Lynchburg, and to iron furnaces on line of canal, 250 miles @ 2.5 mills per ton per mile.....	187,500
200,000 tons coal from Kanawha valley to Richmond, 400 miles @ 2 mills per ton per mile.....	160,000
500,000 tons coal from Kanawha valley to New York and other eastern cities via Richmond, 400 miles @ 2 mills per ton per mile.....	400,000
Revenue from tonnage of Kanawha westward.....	400,000
Revenue from Richmond dock.....	400,000
Revenue from water rents.....	30,000
Revenue from boats and passengers.....	100,000
Expenses of repairs and administration \$750 per mile.....	\$9,028,900
	363,750
Nett revenue.....	\$8,665,150
Which is more than 16 per cent. on a capital of.....	\$53,000,000

It is legitimate to conclude that this work, which will be open for business throughout almost the whole year, will compare favorably in its financial results with the Erie canal.

The entire cost of constructing the Erie canal to 1863, was \$38,977,831 (nearly thirty-nine millions.) This sum with interest to 1863 amounted to \$52,491,915. During the same period, the gross receipts from tolls were \$71,783,676 (nearly seventy-two millions.) After deducting expenses (\$12,518,860) there remained a net profit of \$59,264,812, not only sufficient to pay the entire cost of construction with interest, but leaving a surplus of nearly *seven millions of dollars*. Of the gross earnings it appears that but little more than *one-sixth* was required to meet expenses and repairs. *Five-sixths* were net gain. This included not only the period after the enlargement, but before, when the canal was in an unfinished condition, with cost of repairs greater and receipts less. Since 1862, the net earnings have been about *twenty millions of dollars more*. From 1862 to the end of the fiscal year 1868, the amount of tolls paid to the state was \$25,260,384. No other improvement, railroad or other, can make such an exhibit. The Erie canal has not only paid for its own construction, but makes *itself* a present to the state, with about \$27,000,000 of net profit.

#### *Freedom of the Virginia Water Line from Ice.*

Accurate memoranda have been kept of the number of days during which the Virginia canal has been closed by ice for twenty years past, and the grand aggregate for the whole period has been only 302 days, or an average of 15 days each year. During ten of these years there was no closure by freezing. But the closure during any one season is never continuous, being broken by intervals of thaw. The ice during these freezings is scarcely ever so thick that it cannot be readily broken by ice-boats. These freezings, therefore, can never operate seriously to put a stop to navigation. Boats may continue to run throughout the season without apprehension of any longer detention at any one time than a few days.

The reports alluded to, of the number of days of closing by ice, refer to the mountain portion of the Virginia canal; to wit, the portion which passes through the Blue Ridge.

The summit section, being a tunnel, will never freeze. The unvarying temperature of the tunnel through the Hoosac mountain, in the high latitude of Massachusetts, is 52° the year round. The temperature of the proposed tunnel through the Alleghany mountains for the summit level, will probably not be lower than that of the Hoosac tunnel.

The elevation of the former tunnel is only 1700 feet above the level of the sea, and it is more than three degrees of latitude to the south of the Hoosac.

*Danger from floods of the Mountain sections of the Canal.*

It is popularly supposed that canals through mountain sections of country are exceedingly liable to injury from floods. Experience seems to teach, however, that this is an unfounded apprehension. From the letter of Mr. Lorraine on this subject accompanying this report, it will be seen that the mountain sections of the James River and Kanawha canal have suffered no more from this cause than the sections in the low country, and that the cost of annual repairs on the mountain sections is no greater. Reference is made to Mr. Lorraine's letter appended to this report for valuable and interesting information on this subject.

*Relative cost of Road and Water Transportation.*

The most important element entering into the question of an additional canal, constructed as proposed, on the most direct and central route of the continent from the centre of the interior field of production to the central shipping port of the seaboard, is the subject of the relative cheapness of carriage over long distances by water and by rail. Mr. Lorraine, adopting the conclusions of Mr. McAlpine of New York, presents the following table as indicating the cost of carrying produce over different sorts of route:

Ocean—Transportation, average.....	1.5 mills.
Lakes—Long.....	2.0 mills.
Short.....	3.4 mills.
Rivers—Hudson and of similar character.....	2.5 mills.
Mississippi and Ohio.....	3.0 mills.
Canal—Erie enlargement.....	4.0 mills.
Ordinary size.....	5.0 mills.
Railroads—Average.....	15.0 mills.

Over common roads wheat cannot go to market over a greater distance than 250 miles, nor corn farther than 125. But if railroads can carry produce at as low a rate as one and a quarter cents per ton per mile, the radii within which corn and wheat can be carried by them to market is increased respectively to 1600 and 3200 miles.

But if we assume five mills as the cost of freight on canal and river navigation (which is higher than necessary), then wheat may be brought from a distance of 6000 miles, still leaving 60 cents a bushel to the farmer, and corn from points 3000 miles from market, leaving the cost of production to the grower. Upon the scale of charges indicated in the statement which we have given above, Mr. Lorraine has computed the following table, shewing the saving in the cost of transportation which would result to the West from the construction of the Virginia water line.

It is not contended that these tables show actual costs. They only show the result of applying the average rates, drawn from a great multitude of transactions, to the distances respectively indicated.

## ROUTES.

	Distance.	Cost per ton. \$ c.	Distance in favor of Virginia Water- line.	Distance against Virginia Water- line.	Cost in favor of Virginia Water- line. \$ c.
Dubuque to Hampton Roads by Virginia water-line.....	1,977	6 52			
Do. to New York by railroads.....	1,145	17 17	.....	832	10 65
Do. to New York by Chicago, lakes and Erie canal	1,731	6 88	.....	246	36
Do. to do. by Toledo, do. do. do. do.	1,185	9 22	.....	792	2 70
Do. to do. by Mississippi and ocean.....	3,515	7 86	1,538		1 34
St. Louis to Hampton roads by Virginia water-line.....	1,513	5 13			
Do. to New York by Illinois and Michigan and Erie canals.....	1,960	5 89	447	.....	76
St. Louis to New York by Portsmouth, Ohio and Erie canals.....	1,813	6 70	300	.....	1 57
St. Louis to New York by Mississippi river and ocean,	3,051	6 47	.....	.....	1 34
Louisville to Hampton Roads by Virginia water-line...	949	3 44			
Do. to New York by Portsmouth, Ohio and Erie canals .....	1,249	5 01	300	.....	1 57
Evansville to Hampton roads by Virginia water-line....	1,140	4 01			
Do. to New York by Wabash and Erie canals...	1,220	5 07	80	.....	1 06
Cincinnati to Hampton Roads by Virginia water-line...	816	3 04			
Do. to New York by Portsmouth, Ohio and Erie canals.....	1,116	4 61	300	.....	1 57
Cincinnati to New York by Miami and Erie canals.....	1,019	4 07	203	.....	1 03
Do. to New York by Mississippi river and ocean,	3,398	7 51	2,582	.....	4 47
Wheeling to Baltimore by Baltimore and Ohio railroad,	380	5 70			
Do. to Hampton Roads by Virginia water-line....	787	2 95	.....	407	2 75
St. Louis to Liverpool by New Orleans.....	6,529	11 69			
Do. to do. by Virginia water-line.....	5,223	10 79	1,306	.....	90
Cincinnati to do. by New Orleans.....	6,876	12 73			
Do. to do. by Virginia water-line.....	4,526	8 70	2,350	.....	4 03
Louisville to do. by New Orleans.....	6,743	12 33			
Do. to do. by Virginia water-line.....	4,659	9 10	1,863	.....	3 23
Memphis to Norfolk by railroad.....	956	14 34			
Do. to do. by Virginia water line.....	1,583	5 34	.....	627	9 00

The cost of transportation is a loss in the value of the product of the industry of the country, whether agricultural, mineral or manufacturing, except to the extent of the clear profit to the carriers, and it diminishes the value at home of every thing which will not bear transportation in the same proportion. This loss and this diminution is measured by *hundreds of millions of dollars annually*. There is a point beyond which the necessary charges of railroad transportation in conveying heavy freight from the place of production to the place of consumption leave no profit to the producer, and thus check both production and consumption. From Dubuque, only 188 miles by railroad west of Chicago, the charges, when the water line through the lakes and Erie canal is closed, usually average per ton for fourth class freight (which pays least) to New York, \$23, or at the rate of 69 cents on a bushel of Wheat; for first, second and third classes they range from \$31 to \$49 per ton. When wheat is worth there about \$1 per bushel, it costs about 70 per cent. of its value to carry it to market. From 100 miles in the interior of Iowa, the farmer who has 1,000 bushels of wheat has to give 500 bushels to carry the other 500 bushels to the Atlantic market. On all other cereals, the percentage on the value paid for transportation is still greater.

West of the Missouri river from Sioux city, Omaha, Leavenworth and Kansas city, there is a country extending for hundreds of miles still farther from the Atlantic, with immense capacity for the production of wheat and corn, beef and pork, which must remain valueless as a grain producing region, though of almost boundless capacity for the smaller cereals, unless a less costly means of sending its produce to market be furnished, than by railroad, or even by railroad and the lakes. Nor are the railroad charges necessarily extortionate; they are much lower than the average of charges, and from the far West often lower than the roads can carry at with profit.

The two great railroads of New York, the Erie and the New York Central, struggling as they have been, in competition with each other, and trying even to compete with the Erie canal, ought to be regarded as able to carry freight on as favorable terms as any other lines for transportation of ordinary produce freight and merchandise, and which are also used as lines of travel. Roads constructed as coal roads, with grades and curves to suit an immense freight, may, and in some instances do, carry at a lower rate. But these latter bear no resemblance to the nature of structure and operating expenses of such lines as must be relied on for conducting the freight and passenger business between the Atlantic and the West.

Taking the two principal New York roads then as an average of what such roads can do, their reports for the year 1866 show that the rates per ton per mile for that year were as follows: New York Central 2.92 cents, or for the whole distance of 440 miles from Buffalo to New York, the sum of \$12 85, or at the rate of 35.6

cents for a bushel of wheat. Erie Railroad 2.45 cents, or for the whole distance from Erie to New York of 460 miles \$11 27, or for a bushel of wheat 34.4 cents.

Official reports for 1868 show that the average charges for transportation on the New York roads for that year were a fraction over 2½ cents per ton per mile. These charges will average from the Mississippi about \$24 a ton, or about 72 cents for a bushel of wheat. There may be exceptional cases, under peculiar circumstances, where the charges may be temporarily somewhat lower; but they oftener exceed than fall short of that amount.

During the season of navigation with railroad transportation only to the lakes, these charges could be considerably reduced, and are much lower when there is not a pressure upon the tonnage capacity of the lake vessels and of the Erie canal.

During the earlier part of the navigation season, especially during summer, the charges from Chicago to Buffalo range from about 5 to 10 cents per bushel on wheat, and from Buffalo to New York, through the canal, from about 11 to 14 cents, tolls included; while during September, October and November, when the bulk of the western crop is seeking a market, the charges go up from 10 to over 26 cents from Chicago to Buffalo, and from Buffalo to New York from 14 to as high as 30 cents per bushel, averaging more than double the rates at which freight can be carried, and is carried when there is no pressure upon the shipping of the lakes and upon the canal. These charges are of course increased or diminished in like proportion as to all other freights.

The effort to escape still higher charges by railroad, presses the products of the West upon the water line, and thus enables the carriers, whether by lake or canal, to increase their charges, and the canal company is also thus enabled to increase its rate of tolls; of which advantage both carrier and canal company are not slow to avail themselves.

With the increasing products of the West and Northwest, this evil will continue to increase. Even the advantage of a water line connecting the upper Mississippi with the lakes, and thereby cheapening the transportation to one-third the present charges for that portion of the route, will be to a great extent neutralized by the increased pressure, and consequently higher charges from the lakes inward unless the pressure is relieved and held in check by the competition of other cheap and continuous water lines of transportation.

#### *Relation of the Work to Coal supply.*

It is well known to geological men that the veins of bituminous coal which pervade the entire western slope of the Appalachian chain of mountains, have their maximum aggregate thickness in the Kanawha valley and in the adjacent regions of West Virginia, Kentucky and Ohio.

The coals of these regions are now shipped around by way of

New Orleans and the gulf to New York, at a profit to the miner and dealer. The quality of this cannel coal is equal to that of the coals of England and Nova Scotia imported into New York. It has become important to the manufacturing interests of the seaboard cities to obtain adequate supplies of the best qualities of bituminous coals from shorter distances than those from which they are now derived, and at cheaper rates. The most intelligent manufacturers and dealers in coal, of New York and the eastern cities, recognize the necessity of a resort to the cannel and bituminous coals of the Kanawha, Coal, Guyandotte and Sandy rivers for fuel; a fact which is fully established by the shipments that are now making of the coals of that region by the roundabout route of New Orleans to the Atlantic seaboard.

The opening of the Virginia canal will settle the question of an adequate coal supply for the eastern cities, and relieve the apprehension and scarcity now felt by eastern manufacturers on that vital subject. Valuable as this water line will be to the West as shown in these pages, its importance is doubled by the fact that the work is vital to the success of the manufacturing system of the east, as a means of supplying the best bituminous coals of the continent from the nearest mines by the most direct navigation and at the cheapest rates.

#### THE THIRD RESOLUTION.

III. Your committee approve the third resolution submitted for their consideration, which declares that this work, being of great national importance, is "entitled to receive such aid from the national government as will secure its completion at the earliest possible period."

One of the most distinguished American statesmen of a former generation said, twenty-five years ago:

"The invention of Fulton has, in reality for all practical purposes converted the Mississippi, with all its great tributaries, into an inland sea. Regarding it as such, I am prepared to place it on the same footing with the gulf and Atlantic coasts, the Chesapeake and Delaware bays, and the lakes, in reference to the superintendence of the general government over its navigation. It is manifest that it is far beyond the power of individuals or of separate states to supervise it, as there are eighteen states including Texas and the territories—more than half the Union—which lie within the valley of the Mississippi or border on its navigable tributaries."

*Claims of the great communities, interested in cheap freights and cheap food, upon government for aid to this national work.*

If the work under discussion be necessary to the accomplishment of the two great objects, of affording adequate means of outlet to market for the products of the interior, and supplying cheap food to the populations of the Atlantic states; if, moreover, this work

be a necessary supplement to the navigation of the Mississippi river and its tributaries; then, all that is predicated as to the duty of the government with reference to the western rivers, is true with reference to the proposed outlet of their navigation, by the shortest and most central line to the ocean. And, when we consider that in time of war, both of the other existing routes of water transportation between the interior and the Atlantic seaboard, are liable to complete interruption, leaving the West glutted with vast stores of surplus food, and the east suffering from the want of it—the failure of government to provide an outlet of interior navigation, on the most direct and central route from the Mississippi to the ocean, safe from hostile assault or threat, assumes a serious aspect. We come on reflection to regard the provision of such an outlet as an urgent duty of government, and to look upon the neglect to provide one, as a grave dereliction.

Commodore Maury makes the following cogent reflections upon this subject:

“In case of a war, in which Canada should become the seat, the farmers of the West may well ask the question, what would become of them? The lakes would be impassable to vessels of commerce, and their produce, as recent experience has abundantly taught them, could not afford to pay railway freights and monopolies that Eastern combinations would be sure to exact.

“The only inland water line by which the Mississippi valley can be connected with the ocean, so as to have at all times, and under all circumstances, in peace and in war, a convenient and unmolested highway to the Atlantic sea-front, leads through Virginia. The Alleghany mountains afford no passes for such to the north of us, and, until the country avails itself of these, there is no protection in war for western commerce, and farmers there must console themselves as best they may, under the humiliating reflection that they are cut off with their produce from commercial intercourse with the great markets of their country, from the metropolis of the nation, and from the highway of nations: that if they go by lake or gulf, the way is not their own, but such as others may overlook, and, at pleasure, dispute and endanger, if not forbid. Whereas, their rights through Virginia none can dispute, and the way is wholly their own, and as safe and secure in war as in peace.

“In short, considering that the expenses via New Orleans and the Florida Pass are, in a great measure, prohibitory to north-western breadstuffs, and that the Erie canal has not the capacity to pass more of western produce than it is now doing, and that this produce cannot stand the charges of railway transportation from its place of production to New York, Philadelphia and Baltimore, it is clear that western farmers can contribute but little more to the exports of the country until a new way to the sea has been opened for them. Until this be granted them, the commerce of that portion of the country cannot expand proportionally with the growth of the West.”

*Recommendations of the Committee.*

Your committee find that the present works of the James River and Kanawha Company furnish a basis of credit to the amount of \$10,000,000, free from encumbrance, except a mortgage securing a debt (not all issued) of \$750,000. The further sum of \$40,000,000 will be required for enlarging present works, and completing the remainder of the line to the Ohio river. The whole work can be executed in the period of four years. The expenditure will therefore be made nearly at the rate of \$10,000,000 a year, during which period the earnings of the line pay but a small portion of the interest on the outlay. The maximum of interest which will thus be paid, while the work is under construction, may reach six millions of dollars; so that a lien taken upon the present works of the company, worth ten millions, and upon the property of the entire line, will secure the advance of six millions required for interest, and for the bonds which may be used in providing the means of paying for construction.

It will have been seen that the state of Virginia, the cities of Richmond and Lynchburg, and Washington College, own together 110,541 shares of the capital stock of the James River and Kanawha Company; while only 13,459 shares are owned by private individuals; the State herself owning 104,000 shares, or more than four-fifths of the stock. The national government, therefore, in dealing with this company, would practically be dealing with the State herself.

As shown by the estimates of the engineer, the net annual income expected from the line, when completed, will be \$8,665,150. If we deduct one-fourth of this amount for errors and contingencies, there will remain \$6,500,000. The interest on \$40,000,000 will be \$2,400,000. The net income will therefore pay the interest on the bonded debt, and produce a balance, clear of charges, of \$4,100,000, which may be used as a sinking fund for the liquidation of the debt in ten years. Actual results attending the operation of the Erie canal sustain the validity of these calculations, and justify your committee in the recommendations they submit.

With the foregoing statements as to the commerce of the inland states, which have been carefully and considerately prepared, and as to existing and contemplated means for transporting the materials of that commerce, your committee come to the following conclusions:

That cheap transportation for the products of the interior of the country is not only a necessity, but is demanded by the highest considerations of public policy.

That to secure it, additional direct and continuous lines of water communication are imperatively needed, and should be provided between the Mississippi river and the Atlantic seaboard—not only as a means of freightage, but in order that requisite competition may be maintained between transportation lines.

That as one of these means of water communication, the route to be afforded by the James River and Kanawha canal, if extended to the Ohio river as proposed, has special prominence.

That the work necessary for the completion of this canal on the scale deemed essential for its great objects is demonstrated by eminent engineers to be practicable of early completion and feasible.

That such a work would be national in its character and entitled to receive national aid to secure its completion at the earliest possible period.

That in order that it shall enure to the best interests of the country all private and corporate proprietorship in it should be removed (which removal should be a condition precedent to the grant of aid by the general government), and when the cost of construction as represented by the outlay of the state of Virginia and of the nation shall be fully reimbursed, that the commerce conducted on the canal shall be subjected only to such tolls as may be necessary for its repair.

As embodying these conclusions, it is respectfully recommended that the executive council of the National Board of Trade be directed to memorialize the congress of the United States in reference to the subject of extending aid to the James river and Kanawha canal project, as herein set forth, praying its consideration at an early day.

J. J. PORTER, *Chairman,*  
*Louisville.*

JNO. A. GANO,  
*Cincinnati.*

I. Y. MUNN,  
*Chicago.*

THOS. M. MONROE,  
*Dubuque.*

R. TOPP,  
*Memphis.*

J. P. WETHERILL,  
*Philadelphia.*

R. W. HUGHES,  
*Norfolk.*

CHAS. S. CARRINGTON,  
*Richmond.*



## OFFICE OF THE JAMES RIVER &amp; KANAWHA Co.

*Richmond, February 5, 1869.*

R. W. HUGHES, Esq.,

*Chairman Sub-committee to draft report:*

DEAR SIR:—At your request I offer the following facts in answer to the objections made to canals in mountain districts.

It is granted that a canal in a mountain country is, on account of the lockage, less profitable than one on a level plane, exactly as a railroad with high grades and sharp curves is less profitable than one with low grades and easy curves; but it is denied that there is anything inherent in mountain countries to render the construction or maintenance of canals impracticable or unprofitable, any more than railroads or common roads.

The main objections that have been urged against mountain canals are, that the works are injured or destroyed, and the prism of the canal filled up by the mountain torrents falling into them, and especially on Lock and Dam improvements that the dams are broken and swept away by the sudden incursions of high water, subjecting the navigation to frequent interruptions and long delays.

To meet these objections it is not necessary to refer to canals in foreign countries or in other states, they can be best answered by an appeal to the history and condition of the James River and Kanawha canal; and as the objections were made mainly in opposition to the continuation of that canal, it appears to be eminently fit that it should appear in its own defence, and appeal to the facts in its own history in contradiction of any statements injuriously affecting its future career.

The James river canal commences at Richmond and extends to Lynchburg, a distance of  $146\frac{1}{2}$  miles, the lockage in this distance is 429 feet, or nearly  $3\frac{1}{2}$  feet to the mile. At Lynchburg it may be said to enter the mountain district of the state, and 24 miles above Lynchburg it arrives at the base of the Blue Ridge mountain, passes in a distance of  $4\frac{1}{2}$  miles through the backbone of the Blue Ridge, and then through what is called the Valley of Virginia to Buchanan. The whole distance from Lynchburg to Buchanan is 50 miles, and the lockage between those points is 299 feet, or about six feet per mile. Twenty-two miles is canal, and twenty-eight miles is lock and dam navigation. At the mouth of North river, 28 miles above Lynchburg, there is a lateral canal extending along the margin of North river to Lexington a distance of  $19\frac{3}{4}$  miles, 10 miles of which is canal, and  $9\frac{3}{4}$  miles is slack water navigation, the total lockage being 188 feet or  $9\frac{1}{2}$  feet to the mile.

Between Lynchburg and Buchanan there are four stone dams and seven timber dams. On the North river improvement there are nine stone dams and one timber dam.

Where the canal passes through the Blue Ridge mountain there is in a distance of  $4\frac{1}{2}$  miles a lockage of  $60\frac{1}{4}$  feet, or an ascent of  $13\frac{3}{8}{\frac{1}{6}}\frac{1}{6}$  feet per mile.

The canal from Lynchburg to Buchanan was completed in 1850, and has been in operation 18 years. During that time there have been many and very high freshes, and it is not to be denied that considerable damage has been inflicted; a part of the top of two of the dams has been swept away and a large breach occurred around the abutment of another, and two large breaches have occurred in the guard bank of another. But there was no necessity that any of these disasters should have occurred; they were not the consequences of the character of the country, because nearly as many and similar accidents have happened on the first division, but of errors in the location and construction of the work, errors which experience would have avoided, and which will not be likely to occur again. But the most remarkable fact in this connection is, that the portion of the canal which passes through the heart of the Blue Ridge is the very part that has been most exempt from injury, and has cost less for its maintenance and repair, in proportion to its lockage, than any other part of the line. One reason of this is that it passes through an uncultivated section of country, and therefore there is but little deposit washed into the canal from the sides of the mountain, or by the small streams that empty in it.

On the North river improvement, which traverses along the western base of the Blue Ridge, where the fall is  $9\frac{1}{2}$  feet to the mile, and where there is a dam for every two miles, no accident has ever happened to a dam from high water. One dam has partially failed, from having been built on an insecure foundation. This portion of the improvement was constructed with inadequate funds, and consequently the work was of an inferior description. The dams were built of rubble masonry and without cement, nevertheless, with the exception mentioned above, they have stood well and have suffered no injury from the frequent high freshes to which they have been subjected.

A pretty good test of the comparative stability of mountain canals may be made by a comparison of the cost of repairs of the 1st and 2nd divisions of the canal as shown in the following tables, ranging from 1851 to 1868 inclusive.

*Cost of Repairs of J. R. & K. Canal for 18 years, from 1851 to 1868.*

	Length miles.	Lockage feet.	Total Cost for 18 years.	Average Cost per annum.	Cost per mile per annum.	
1st Division—Piedmont,	146 $\frac{1}{2}$	429	\$1,819,589	\$101,088 00	\$690 00	
2nd Division—Mountain,	50	299	726,871	40,382	807 00	

It will be seen from the above table that the cost of repairs of

the 2nd or mountain Division of the canal was about 17 per cent. more than that of the first or Piedmont Division, which may readily be accounted for by the increased number of mechanical structures on the mountain division, there being on the first division a lock for every  $2\frac{2}{3}$  miles, and a dam for every 16 miles, while on the second division there is a lock for every  $1\frac{3}{10}$  miles and a dam for every  $3\frac{1}{2}$  miles.

But if we include the North river improvement the comparison is still more favorable for the mountain division as will be seen by the following table.

*Cost of Repairs of J. R. & K. Canal for 8 years, from 1861 to 1868.*

	Length miles.	Lockage feet.	Total Cost for 8 years.	Average Cost per annum.	Cost per mile per annum.
1st Division,	146 $\frac{1}{2}$	429	\$1,111,468	\$138,933	\$948 00
2nd Division and North River Improvement,	69 $\frac{3}{4}$	487	529,669	66,208	949 00*

It will thus be seen, that for the last eight years the cost of repairs of the mountain division has been about the same per mile as that of the Piedmont division, after adding on to it  $19\frac{3}{4}$  miles of what may be more strictly called mountain canal than any other portion of the line, a canal that has a lock for every nine-tenths of a mile, and a dam for every two miles, and an average fall of nine and a half feet to the mile.

The stability of the North river canal and the small cost of its repairs (only \$356 per mile per annum for the last 8 years), notwithstanding its imperfect construction, is a standing reply to any objections that may be urged against the improvement of the Greenbrier and New rivers by locks and dams. The fall in the Greenbrier is  $6\frac{3}{10}$  feet per mile, very nearly the same as that in the James from Lynchburg to Buchanan; there can, therefore, be hardly any reasonable objection raised to the improvement of *that* river. The fall in New river averages  $10\frac{4}{10}$  feet per mile or about ten inches more per mile than that in North river. Is there anything then in the characteristics of New river to render its improvement impracticable or even formidable? We have seen that the North river with nearly as much fall, and the James river through the heart of the Blue Ridge with three feet more fall per mile, have been successfully improved, and that these portions of the canal have cost less to maintain them than any other part of the canal. Moreover, as already remarked, the character of the work on the North river is inferior, the dams being built of dry rubble masonry. It is intended to construct the locks and dams

\*The reason why the average cost per mile appears to be so much greater during the last eight years is that for four years, or one half the time, the cost is computed in Confederate currency. For the same reason, though in a less degree, the average annual cost of repairs in the first table is considerably increased. The average cost per mile for the ten years preceding 1861, was \$483 on the 1st Division, and \$506 on the 2nd Division.

on the New river of the very best description of mortared masonry, that will defy the invasions of the river, let it rage never so high. I feel confident on that score, from the long experience that I have had in building dams, and from the improvements in their construction that have been suggested and adopted, after much observation of the causes of the failure of some of the stone dams on James river. These improvements consist chiefly in varying the proportions of the dams without increasing their area of cross-section, or in giving them less thickness at the bottom and more at the top; giving a double slope to the coping, and protecting it with timber and plank. New dams recently constructed on these principles, below the old dams, have, even when unfinished, stood such tests as I am sure they never could be subjected to under any other circumstances.

New river runs chiefly through a wild, uncultivated country, its banks are rock bound and wooded, and consequently the ponds will not be so liable to be filled up by deposits from the hill sides, as they would be if they were bounded by cultivated lands.

There need be no apprehension in regard to the extraordinary height of the freshes in New river, because, after a fresh has passed a certain height, by the equalization of the water above and below the dam, the danger begins to diminish, and there is really no more danger to the dams in a very high fresh than in one of ordinary height, and the double slope given to the combs of the dams will throw the water in its overfall so far from the base as to prevent any danger of undermining the foundations.

It is my opinion that the work on the Greenbrier and New rivers, if properly executed, will be the most permanent, and will cost less per mile to repair than any other part of the line, except the Kanawha river.

Very Respectfully,

E. LORRAINE,  
*Engineer & Superintendent.*





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